DIRECT TESTIMONY OF

LAURA MANZ

ON BEHALF OF

DOMINION ENERGY SOUTH CAROLINA, INC.

DOCKET NO. 2019-365-E

Q. PLEASE STATE YOUR NAME, BUSINESS ADDRESS, AND CURRENT POSITION.

A. My name is Laura J. Manz. My business address is 35 Iron Point Circle, Suite 225, Folsom, CA 95630. I am employed by Guidehouse, Inc. as Director – Power Delivery Solutions.

Q. DESCRIBE YOUR EDUCATIONAL BACKGROUND AND BUSINESS EXPERIENCE.

A. I have over 35 years of experience in the electric power industry. I am certified as a power grid dispatcher and have managed transmission planning and resource interconnections for decades, including Manager – Transmission Planning for Public Service Electric & Gas (PSE&G) and Vice President – Market and Infrastructure Development for the California Independent System Operator (CAISO). At CAISO, I was the executive responsible for the redesign of the power grid configuration and interconnection policies to incorporate 20% and 33% renewable energy targets into the supply portfolio under Governor Schwarzenegger.

I also oversaw the resource interconnection program including CAISO's cluster study process.

At Guidehouse, I lead solutions related to the planning and operations of the power grid, including grid enhancement and expansion and resource interconnection. I work with clients around the globe on system operations, electricity markets, transmission and distribution planning and regulatory policies. My clients include regulators, utilities, resource developers and power producers. I hold a B.S. in Electrical Engineering from Lafayette College and an MBA from Drexel University.

Q. HAVE YOU PREVIOUSLY PRESENTED TESTIMONY BEFORE THE PUBLIC SERVICE COMMISSION OF SOUTH CAROLINA ("COMMISSION")?

A. No. I have provided testimony in California, New Jersey and before the Federal Energy Regulatory Commission (FERC). I have supported testimony in Hawaii, Mississippi, Colorado, and North Carolina related to grid operations and resource interconnections.

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS PROCEEDING?

A. The purpose of this testimony is to address the areas raised by the Commission with respect to the interconnection and integration of energy, as they relate specifically to a competitive procurement of renewable energy ("CPRE") process. My testimony addresses 1) best practices along with, the primary drivers of a workable interconnection process to support the competitive procurement of renewable energy, 2) benefits and monetary savings associated with establishing and administering competitive procurement programs for the utility and the ratepayer based on sound interconnection policies, 3) challenges and costs associated with CPRE programs for the utility and for the ratepayer and 4) impact of addition of competitive procurement upon other areas including the IRP process, interconnection, energy storage and queue reform.

Q. HAVE YOU INCLUDED ANY EXHIBITS WITH YOUR TESTIMONY?

A. Yes, I am sponsoring Exhibit No. __(LM-1) that contains my professional resume.

Q. WHY ARE INTERCONNECTION POLICIES IMPORTANT TO A CPRE?

A. As stated in the testimony of Witness Koujak, a best practice for evaluating CPRE proposals includes an evaluation of project Net Benefits. The benefits assessment includes the cost of the infrastructure to interconnect (Interconnection Cost) and deliver (Network Cost) resources selected for long-term contracts.

Interconnection Costs are those costs associated with the direct connection of the project to the Utility grid. Network Costs are upgrade investments made on the existing grid infrastructure required to ensure reliable delivery of power flow from the project across the entire Utility grid. Interconnection polices determine how Network Costs are assigned or shared and directly impact the evaluation of Net Benefit each proposed CPRE project.

Q. WHAT HAVE BEEN THE CHALLENGES FOR THE INTERCONNECTION OF RESOURCES AS A RESULT OF CPRE PROGRAMS?

A. CPRE programs introduce complexity with regard to how a utility performs interconnection planning studies and assigns Network Costs. A CPRE must balance the interests of existing queued projects (PURPA and otherwise) with the ability to timely study CPRE-proposed projects ahead of other pending projects. Most utilities utilize a "first come, first served" or "serial" approach to study the impact a project has on the grid and to assign any Network Costs required to ensure reliable deliverability of energy from the project.

Under a serial study approach, the evaluation process can be difficult and lengthy. In assessing the Net Benefit of each proposed project, the evaluator must include the Network Costs assigned to that project. Using the serial approach also means that only the early resource(s) in line or the Interconnection Queue (Queue)

can use any latent capability in the power grid, leaving potentially costly upgrades on later resources that are further back in the Queue. The high cost of an infrastructure upgrade may render a resource commercially unviable, potentially forcing them out of the process, requiring new studies and cost shifts. Serial study procedures can also result in resources that are ready for commercial operation being delayed in their ability to connect and deliver power, even if the resource is successful in a CPRE solicitation. Policies that move forward projects that are ready and share costs among the procurement winners can avert a cascading effect that could lead to a re-do of the entire process.

Q. WHAT ARE SUCCESSFUL APPROACHES TO INTERCONNECTION FOR EFFECTIVE IMPLEMENTATION OF CPRE PROGRAMS?

A. Using a "cluster study" approach that allows all successfully bid projects to share Network Costs reduces planning study and CPRE evaluation complexity. In a cluster study approach, some infrastructure costs are individually borne, and other costs may be shared by groups of connecting resources. Costs for "direct connect" facilities are paid in full by the connecting resource. In some regions, the additional infrastructure needed to integrate the energy into the grid is paid by the utility or initially shared among resources and repaid by the resource and is paid back over time by the utility as those facilities become part of the comprehensive network. A cluster study approach in which some of the cost of expanding the network are

shared by successfully bid projects results in upgrade payments being more equitably allocated. This structured approach improves efficiency, reducing the number of restudies and associated reallocation of network costs to shorten the bid evaluation process.

Cluster studies also enable a "first ready, first served" approach in which successfully bid projects can be interconnected according to their operational readiness. Some successfully bid CPRE projects may be able to move more quickly than others.

Q. WHAT ARE THE OBJECTIVES OF QUEUE REFORM FOR A CPRE?

A. The objective of queue reform is to timely and efficiently connect viable resources. Creating groups or clusters of resources that can be processed through a consolidated study improves the efficiency of performing reliability studies and identifying upgrades that are more suited to the entire group of CPRE resources rather than an individual resource. In addition to a time-based clustering process, resources that are in close electric proximity can be studied together to identify the most cost-beneficial infrastructure upgrades to assure delivery for the successful CPRE resources. Absent the ability to group resources in the study process, timely processing of connection request may be addressed through limiting bid participation to projects with already established queue positions.

Q. WHAT SPECIAL PROVISIONS ARE REQUIRED FOR STORAGE RESOURCES THAT PARTICIPATE IN A CPRE?

A. Since storage can act as both a load and a generator, a technical study must account for the bidirectional nature of the resource. Storage operates differently than intermittent solar so looking at different impacts across time periods, including scenario analysis, can assess impacts under different grid operating conditions across the year, including the winter peak. This is not new for engineers to study resources under different operating configurations and storage does not present a particular challenge from a technical perspective but does require additional modeling to determine the energy and capacity benefits for a proposed project which may impact the CPRE evaluation process timeline.

Q. WHAT ARE THE KEY CHALLENGES ASSOCIATED WITH REFORMING THE INTERCONNECTION PROCESS TO SUPPORT A COMPETITIVE PROCUREMENT PROGRAM?

A. Reforming the processing of resource interconnection has taken place in many areas across the U.S. and several best practices have emerged that include:

- An open window for all resources to identify their technical parameters for study.
- Sufficient time to validate resource data and close any information gaps prior to study launch.

- Withdrawal penalties to discourage speculative projects.
- Simultaneous study of resources, with defined time periods to obtain results.
- Developing a transparent study process that balances existing project interconnection queue rights with the need to efficiently and effectively identify and assign network costs and evaluate the cost-effectiveness of a potentially large number of projects bid into a CPRE.
- Timely preliminary findings for resources to receive preliminary interconnection and integration resource infrastructure estimates.
- Resources afforded the ability to exit the process at predictable stepping off points.
- Complex studies conducted later in the process to avoid time delays and reduce costs of restudy.
- Resources share costs under a 'beneficiaries pay' approach based on a resource's proportional contribution to the need for an infrastructure upgrade.
- Allow ready resources to operate on an 'as infrastructure is available' to deliver the resource until upgrades are complete.

Q. ARE THERE SIGNIFICANT COSTS ASSOCIATED WITH IMPLEMENTING QUEUE REFORMS TO SUPPORT A COMPETITIVE PROCUREMENT PROGRAM?

A. There are regulatory requirements that guide the interconnection process. Preliminary studies to consider the effects of each RFP round can take approximately 2 to 3 months to conduct.

Once winning CPRE resources are selected, the final interconnection study process can take 18 months to identify reliability impacts and additional infrastructure required. Depending on the number of projects requiring study, several planning engineers are required to administer the study process and conduct technical analysis on the low-voltage and high-voltage system. Additional resources are required for administering the process, including managing deposits and refunds.

Q. DOES THIS CONCLUDE YOUR DIRECT TESTIMONY?

A. Yes.

Exhibit No. __(LM-1)

Guidehouse

Laura J. Manz

Director | Energy Sustainability and Infrastructure

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Professional Summary

Ms. Manz brings over 35 years of executive and field experience in electric and natural gas utilities, leading complex and challenging projects for utility, regulator, and developer clients globally. Her expertise is leveraged to advise on strategic and cross-disciplinary areas encompassing grid planning and operations, electricity market design, enabling agreements and tariffs, resource interconnection, rates and ratemaking, distributed energy, and advanced technologies. She was formerly Vice President – Market and Infrastructure Development with the California Independent System Operator (CAISO) where she led regulatory policy, grid planning, market design, distributed energy integration, and reliability compliance.

Her achievements include implementation of wholesale electricity markets in the Mid-Atlantic (PJM), California (CAISO), and Texas (ERCOT). She has served as an expert witness in grid operations, market design, ISO tariff design, microgrids and distributed energy resources, resource interconnections, and project viability diligence that includes environmental considerations and interactions with local, state and federal agencies. She began her career at Public Service Electric and Gas Company (PSE&G) beginning in power plant and power grid operations and planning. She played a key role in transitioning PJM from a power pool to and Independent System Operator / Regional Transmission Organization. She continues to lead strategy development with clients related to open access and market policies, tariff design, rates and ratemaking, strategy for policies and programs for clean and distributed energy, and grid resiliency and hardening. She has led wildfire mitigation plan development and evaluation for utilities in California, Nevada and Washington.

Professional Experience

As a Director with Guidehouse, Laura brings thought leadership and expertise to clients, leveraging her experience in transmission operations and planning, rates and tariffs, reliability and regulatory compliance, renewable and distributed energy integration, and due diligence.

- For Liberty Utilities and Bear Valley Electric Service, led the development of the wildfire mitigation plan and related budgeting processes. Conducted an independent evaluation for Sacramento Municipal Utility District's (SMUD's) inaugural wildfire mitigation plan. Provided expert witness and testimony for litigation for a large California Investor Owned Utility.
- Led the development of NV Energy's Natural Disaster Protection Plan (NDPP), including facilitating 13 stakeholder engagement sessions to receive feedback prior to filing with the regulatory commission. Led advisory services for ongoing updates to the NDPP.
- Supported Chelan Public Utilities District #1 to design a public safety outage management plan and related public outreach activites.
- For the California Public Utilities Commission, assessed practices across major IOUs related to Rule 21 distributed energy resource interconnection tariffs and practices that form the basis for new interconnection and integration reforms.
- Led tariff assessment for BC Hydro to evaluate and verify costs of different grid services and propose options for energy imbalance service. The project included conducting an industry scan, analyzing tariffs and rates with a cost allocation model, assessing revenue requirements, and proposing workable options for energy imbalance services.

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- For Hydro Quebec Transmission, led an assessment of independent functioning as a grid operator, including organizational design analysis, industry best practices, tariff reviews, and evaluating operations under different grid resource and infrastructure configurations.
- Led the assessment of Alberta Electric System Operator rate and tariff design. The project included a report for stakeholder discussion realted to key functions of an ISO, evaluation of revenue requirements and rates for the grid operator, transmission infrastructure and grid services. The solution team also proposed rate design options under different economic stress scenarios, such as under COVID-19, to support economic development aspirations of the Province.
- For Oncor led an impact assessment of proposed changes by the regional grid operator, ERCOT, including rate impacts to various stakeholder constituents and a benefit-cost analysis of various proposed changes.
- Established the Queue Reform Consortium for integrating distributed and renewable resources, process reform and stakeholder outreach. Successfully engaged Dominion South Carolina, Public Service of Colorado (PSCo), PacifiCorp, Salt River Project, and Public Service of New Mexico in a consortium to share best industry practices for successful queue reforms and resource integration. This enabled Guidehouse to continue as supplemental engineering staff for interconnection studies. Our clients now include PSCo, GridLiance, DesertLink LLC (LS Power), Salt River Project, and Puget Sound Energy. Included in policy discussions was the development of costs and allocation to interconnecting customers.
- Developed a standardized Grid Service Purchase Agreement (GSPA) so the Hawaiian Electric Companies could procure power grid services under a consolidated agreement that accommodates purchases from aggregated distributed energy resources and traditional power plants.
- Led Wildfire Mitigation Plan (WMP) and Natural Disaster Protection Plan development and filing, including stakeholder outreach and capital investment planning. Led Independent Evaluator project to assess existing WMPs. Advised on new mandates from the Wildfire Safety Division including data collection, metrics, benefit-cost analyses.
- Provided expert witness testimony related to grid planning, grid operations, coordinated electric operations among multiple operating companies, power purchase agreements, project due diligence, and Qualifying Facilities to two separate clients.
- Developed interconnection processes, cost allocation, and enabling agreements for a Public Utility District for connecting high-density load customers to the transmission grid including microgrids and energy-intensive manufacturing. The project included preserving existing bilateral sales contracts and “hold harmless” provisions for existing customers.

As Principal with L J Manz Consulting, a sole proprietorship, advised clients on all aspects of strategic and tactical projects with clients that included Fortune 200 utilities, large industrial customers, and Fisher Family Fund companies.

- Delivered a transmission strategy and roadmap for a Fortune 200 utility and Board of Directors assessing how to leverage provisions under FERC Order 1000 that allow for competitive transmission solicitations for otherwise traditional utility solutions for the best advantage to the Corporation.
- Completed tech-to-market roadmaps and coached “investor pitch” sessions for Department of Energy Advanced Research Projects Agency-Energy (ARPA-E) grant recipients. Won “plus up” supplemental grant funding and led due diligence interactions to successfully secure financial investors for advanced technologies including intelligent volt/var controller and hardware-in-the-loop technologies.

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- Advised on transmission interconnection and siting, environmental permitting, distributed energy resource development, Community Choice Aggregation, storage integration, and asset optimizations.
- Led New York's and California's Distributed Energy Proceedings, the Distribution Planning tracks, to integrating increasing amounts of distributed energy resources and microgrids including interconnection and planning policies to harmonize with impacts on the high voltage grid.
- Conducted a microgrid assessment to integrate solar and storage with a wood products manufacturing facility; converted a Qualifying Facility biomass power plant and sawmill to a California ISO participating resource with renegotiated power purchase agreements.
- Advised the New Zealand Electricity Commission on market reform and harmonizing grid operations, with market design, designing a system of financial rights for the Country's transmission operator.

As Senior Vice President with Viridity Energy Solutions, Inc. an Ormat Company, led microgrid strategy and business growth for Western Interconnection and Texas. Viridity Energy is a leading-edge smart grid technology company that creates virtual power plants and microgrids to improve grid resiliency, reliability and economic benefits.

- Successfully implemented the "grid within a grid" security-constrained economic dispatch of the 50 MW microgrid at University of California, San Diego (UCSD).
- Launched resiliency and economic optimization microgrid programs for Department of the Navy (NAVFAC) in San Diego, California.
- Managed Advanced Technology grant program for the SunShot Initiative and SPIDERS JCTD Smart Cyber-Secure Microgrids implementation.

As Vice President Markets and Infrastructure Development with CAISO, led regulatory policy, transmission planning and electricity market development for California's 50,000 MW grid. Responsibilities included day-to-day and strategic initiatives for transmission planning, grid expansion, market design, transmission maintenance reviews, resource interconnections, and regulatory policy.

- Implemented California's restructured electricity market, bringing nearly 50,000 MW in alignment with international best practices. Held responsibility for ongoing market improvement and grid expansion and the related regulatory policies and tariffs.
- Issued the first Renewable Energy Transmission Initiative (RETI) power grid expansion plan for the State of California pursuant to an Executive Order from Governor Schwarzenegger and spearheaded coordinated planning processes to satisfy reliability, economic, and policy mandates collaboratively among California's public and private transmission owners.
- Oversaw the development and administration of the Open Access Transmission Tariff including regulatory policy and filings with the Federal Energy Regulatory Commission (FERC). Led the review and approval process to gain approval from the CAISO Board of Managers, including market design, reliability practices, revenue requirements and charges for grid services.
- Positioned organization for 100% compliance with FERC, North American Electric Reliability Corporation (NERC), Western Electricity Coordinating Council (WECC), and California Public Utilities Commission (CPUC) infrastructure planning and maintenance requirements.
- Collaborated with state agencies such as the California Air Resources Board (CARB) and State Water Resources Control Board to assure policy objectives such as eliminating once-through cooling, reducing greenhouse gas emissions, and integrating at least 33% of California's supply portfolio with renewable energy resources.

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- Responsible policies to integrate Distributed Energy Resources into the grid dispatch with cutting-edge proof-of-concept deployments.

As a Director CAISO and Regulatory Affairs – SDG&E and Southern California Gas Company, led regulatory policy development and deployment for Sempra Energy's regulated businesses. Responsible for oversight of policy and tariff proposals by the CAISO. Oversaw all of the Case Managers for SDG&E and SoCal Gas, and the organizations' interactions with FERC, CAISO, CPUC, and CEC on all aspects of electric and natural gas policy, rates, and position advocacy.

- Established a policy roundtable to vet positions and advise executive leadership, including the CEO and Chief Regulatory Officer on issues and recommended strategies related to federal and state regulatory proceedings Issues included CAISO tariff and market reform, natural gas rates and service, revenue requirements and rates.
- Developed key policies and related testimony for Sunrise Power Link, CAISO market reform, and unique peak pricing policies such as Critical Peak Pricing.
- Formalized, designed, and launched SDG&E's North American Electric Reliability Corporation reliability compliance program to successfully meet new relialbity mandates and avoiding penalties up to $1 million per day per violation.
- Led the review, stakeholder input and intervention with the CAISO on behalf of SDG&E including policies, relialbity requirements, grid services charges, and obligations as a Participating Transmission Owner.

As a Director with PSEG led PSE&G's transmission and wholesale market activities, harmonized federal, regional, and state electricity policy across PSEG's multiple lines of business related to energy markets, gas and electric rates, reliability compliance, and tariffs for PSEG's portfolio of businesses. Led PSE&G's stakeholder participation with PJM for coordinated operations and planning. Represented PSE&G as part of the Supporting Companies to redesign the organization, tariffs and business practices into compliance with FERC requirements for open access. Career highlights also include:

- Director Interregional Transmission –As part of "The Supporting Companies," transformed PJM, from a coordinated power pool into an Independent System Operator, including design and implementation of the Open Access Transmission Tariff, grid services charges, nodal market pricing system, engagement rules and technology platform for retail choice for customers in New Jersey. PJM remains the most liquid electricity market in the world and New Jersey's Basic Generation Service retail choice program the most successful in the U.S. Initiated new transmission planning, grid expansion, and resource interconnection processes under an ISO Transmission Service Provider model.
- Led PSEG's participation as a Transmission Owner member including cost development, revenue requirements, ratemaking options, rate case filings, and the Transmission Access Charge. Collaborated with PJM to develop FERC "Schedule 1" administrative charges to determine a comprehensive set of costs and revenue requirements and the related filing to FERC to recovery the full set of charges under a Schedule 1 / Schedule 1a allocation.
- Senior System Operator on-shift supervisor responsible for the economic and reliable operation of PSE&Gs 11 MW power grid with $1.5 billion of energy transactions annually for 2 million electric customers. Graduate of PJM System Operator Training certification program.

Expert Appearances and Related Work Products

Federal Energy Regulatory Commission

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Developed testimony and appeared before the FERC on behalf of Public Service Electric and Gas, San Diego Gas and Electric, Southern California Gas Company, Smart Wires, and Tres Amigas, LLC.

- Expert Witness (litigation and settlement) for Public Service Electric and Gas - https://www.ferc.gov/whats-new/comm-meet/2010/091610/E-9.pdf
- Tariff, rates, and rules development and filing California Independent System Operator https://www.caiso.com/Documents/Sections20-24-FourthReplacementCAISOTariff.pdf
- Technical witness, San Diego Gas and Electric https://www.ferc.gov/EventCalendar/Files/20050609143932-Agenda%20Materials%20-%20California.pdf
- Develop electric rates and testimony, San Diego Gas and Electric http://www.caiso.com/Documents/100210ADRAudit-InformationalReport-FERCForm3.pdf
- Develop PJM Supporting Company FERC filing and related testimony including market design and formula rates. Presented at all related FERC technical conferences 1995 through 2005

New Jersey Board of Public Utilities

- Developed testimony for Colin Loxley appearance at the New Jersey Board of Public Utilities http://caselaw.findlaw.com/nj-superior-court-appellate-division/1167132.html

California Public Utilities Commission

- Developed various testimony as an employee of California ISO, SDG&E, Southern California Gas Company, and developers. Topics included multiple aspects of California's Transmission Plan, policy initiatives such as increasing Electric Vehicle adoption, eliminating once-through cooled coastal power plants, achieving greenhouse gas reduction targets, commercial operations of TransBay cable, microgrid deployment, and effects of generation retirements.

Public Utilities Commission of Texas

- Developed testimony and appeared before the commission on behalf of Public Service Electric and Gas, Sempra, ERCOT, and Tres Amigas, LLC. Topics included market design, nodal market risk assessment, routing and siting, reliable interconnection among the U.S.'s three asynchronous grids.

Minnesota Public Utilities Commission

- Appeared before the Commission on behalf of Gridworks Distributed Energy Resource integration project to present California's approach to integrating increasing amounts of distributed energy resources and related transformation approach, including hosting capacity, distribution planning, and integration capability.

Expert Witness

- Provided expert testimony related to interconnection processes and project viability in California including technical interconnection requirements, market analysis including traditional RFP opportunities and Community Choice Aggregation options, and environmental requirements taking into considerations local, state and federal regulations.

Exhibit No. __(LM-1)

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- Provided expert testimony related to pooled grid operations and planning, including the impacts of Qualifying Facilities and Independent Power Producers, benefits of coordinated operations and planning, and evolution of the electricity industry.

Professional Associations

- Institute of Electrical and Electronics Engineers (Senior Member)
- Cleantech San Diego – Education and Outreach Committee
- Association of Women in Water, Energy and Environment (AWWEE)

Education

- Bachelor of Science, Electrical Engineering, Lafayette College, Easton, PA
- Master of Business Administration, Drexel University, Philadelphia, PA

Awards

- San Diego Business Journal “Women Who Mean Business”
- Tribute to Women in Industry (TWIN)